ASCIDIACEA

BY

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Swedish Deep-Sea Expedition of 1947—
llected ascidians of seven species. The
ial was deposited in the Natural History
um, Göteborg, and has been placed at my
sal by Dr. O. NYBELIN, to whom I wish
press my thanks.

e specimens were obtained from the Atlan-
ean at depths ranging from 4,540 to 5,860
s, and make an important contribution to
nowledge of the ascidian fauna of deep
.

ee families are represented in the collec-
and the species are distributed as follows:

Family Agnesiidae ..... 1 species.
» Styelidae ..... 5 »
» Pyuridae ..... 1 »

s remarkable that only one species (*Cule-
uhmi* Herdman) of those collected is known,
the possible exception of *Bathystyeloides
ica* which is closely related to *B. ender-
s* (Michaelsen); these two species may
to be identical, if more specimens become
ble for examination.

Family AGNESIIDAE

Agnesia depressa n. sp.

Fig. 1.

e r i a l : St. 371 (Haul No. 10), N. 24° 12′
63° 23′—N. 24° 28′ W. 63° 18′, August
h 1948; depth 5,850—5,860 m. 4 speci-
ns.

osis.

dy of a depressed ovoid shape. Siphons
y separated. Test with a thick coat of
long hair-like processes. Longitudinal muscles of body wall few and thick.

External appearance.

The four specimens range from 0.8 to 1.1 cm. in greatest diameter. Body of a depressed ovoid shape, almost entirely covered with long fine hair-like processes of the test, which are especially long on the lateral and ventral parts of the body. The siphons are rather widely separated, being more than half the length of the body apart.

Test.

Thin, flexible, and transparent except for a coating of mud; marked internally with longitudinal ridges.

Body wall.

Thin and transparent. The longitudinal muscles are few and thick. Transverse muscles are seen only as rings round the siphons.

Siphons.

The oral siphon is tubular and the atrial siphon almost sessile. Each siphon has a few (about 6?) indistinct lobes.

Oral tentacles.

The oral tentacles are small, simple and probably number 20—30, but were not clearly seen. They stand on a low flange at the base of the siphon.

Dorsal tubercle.

Not clearly seen, but probably small and simple.

Branchial sac.

There are about six transverse bars which project from the wall of the branchial sac as tall narrow flanges. A few slight projections from the transverse bars may represent rudi-

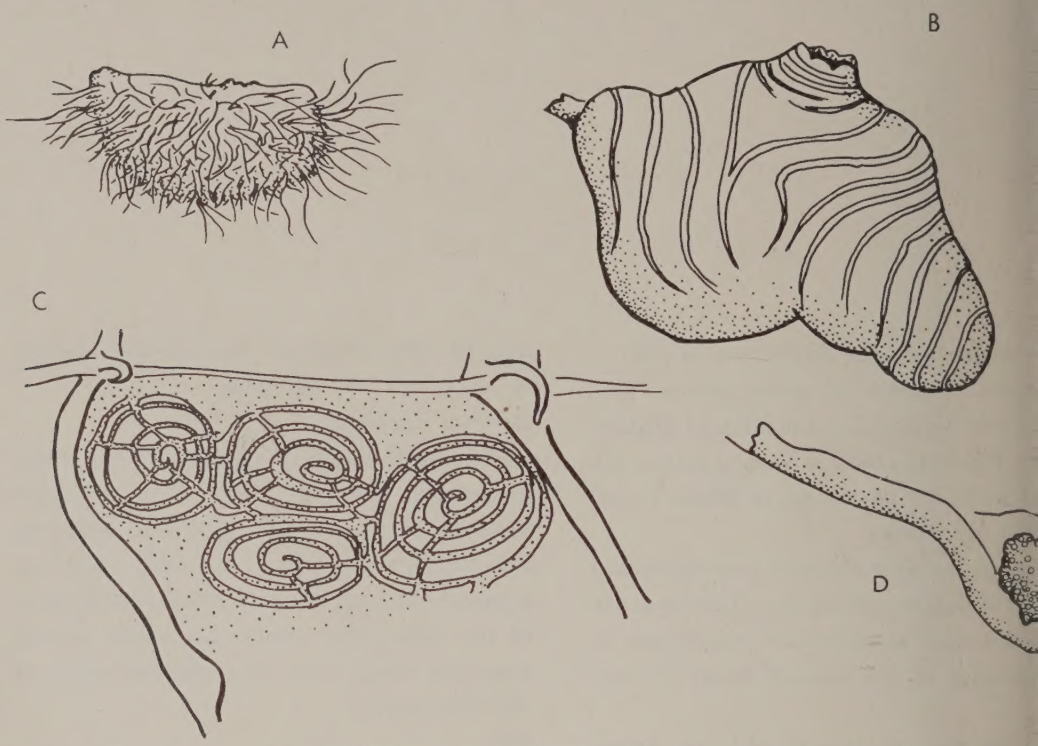


Fig. 1. *Agnesia depressa* n. sp. A, whole specimen; B,specimen with test removed, to show muscles; C, part o line and branchial sac; D, gut and ovary.

mentary papillae or vestigeal longitudinal bars. The dorsal lamina is inconspicuous and with a hooked languet corresponding in position to each transverse bar. There are two rows of stigmata between each two adjacent transverse bars. The stigmata are wide, spiral, and with 4 or 5 turns. Each stigma is crossed by 4 (or more?) slender radial vessels.

Gut.

Not clearly seen. The stomach is ovoid, and the intestine has a simple loop. The rectum is long and narrow with an indistinctly lobed anus.

Gonads.

The ovary is a rounded body lying within the loop of the intestine and slightly to the left of it. Neither the testis nor the genital ducts could be seen.

Remarks.

Agnesia is a small and rather uniform genus. *A. depressa* is distinguished from the known species by its depressed body form, widely separated siphons, and stout longitudinal les.

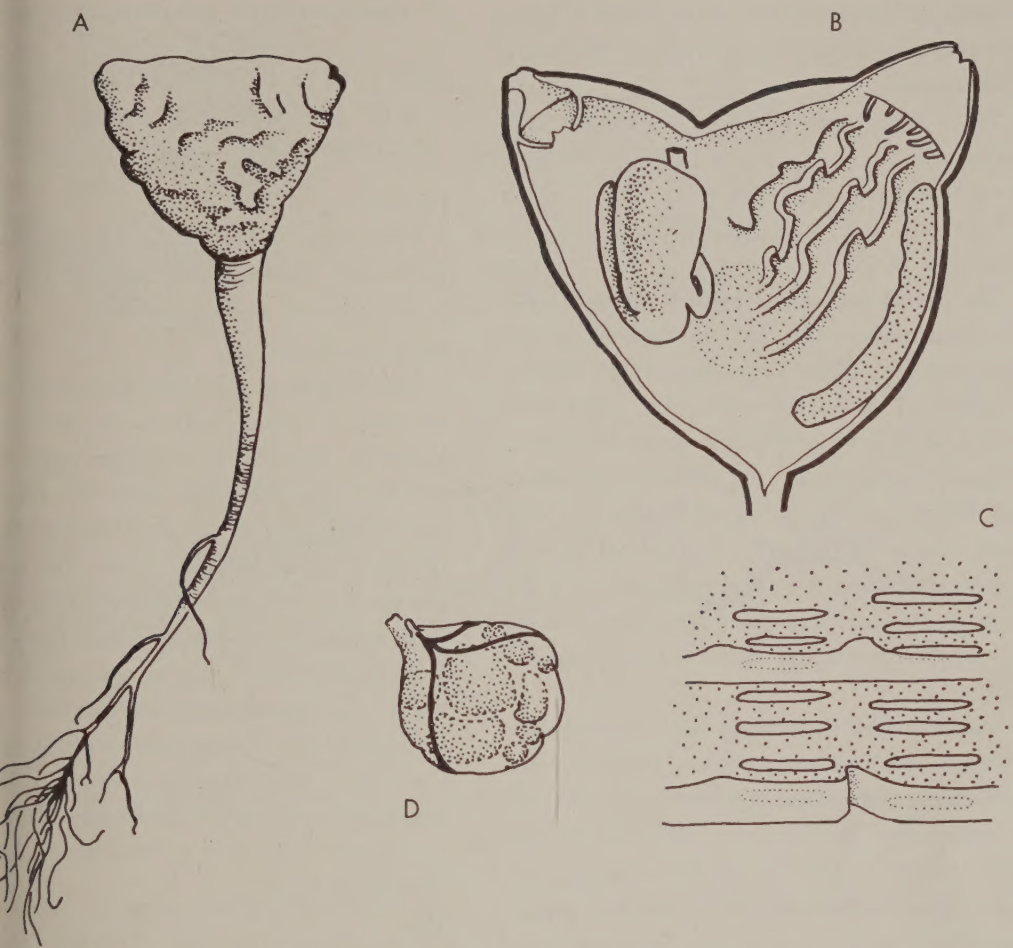
The family Agnesiidae, as pointed o Ärnbäck-Christie-Linde (1938), exhib polarity of distribution. One group of s inhabits the North Pacific, and another inhabits the colder parts of the so hemisphere. *A. depressa* extends the di tion to the Atlantic Ocean, and is th deep-sea species of the family to be rec

Family STYELIDAE

Dicarpa n. gen.

Diagnosis of the genus.

Siphons 4-lobed. Endocarps present. tentacles simple. Dorsal lamina a plain brane. Branchial sac without folds. 3 longitudinal bars on each side of the bra sac. Stigmata straight. One polycarp gonad on each side of the body.



Dicarpa simplex n. gen. n. sp. A, whole specimen; B, body with right half removed, seen from the right, to show branchial sac and gut; C, part of branchial wall; D, gonad.

Dicarpa simplex n. gen. n. sp.

Fig. 2.

erial: St. 387 (Haul No. 13), N 40° 33′ 35° 24′—N 40° 34′ W 35° 52′, September 1948; depth 4,540—4,600 m. 2 specimens.

nal appearance.

ly roughly triangular, with the upper side ng the diverging siphons and the lower roduced into a stalk. Specimen 1; body y 1.6 mm. and stalk 6.0 mm. Specimen dy 2.0 by 1.9 mm. and stalk 10.0 mm. ce of body slightly wrinkled; stalk smoo- out in places also slightly wrinkled. Body rown with a light coating of mud. The lower end of the stalk bears a tuft of slender filaments.

Test.

Thin but firm, and when the light coating of mud is removed, semi-transparent.

Siphons.

Diverging, conical, and each 4-lobed. The oral siphon longer and more distinctly lobed than the atrial siphon.

Body wall.

Thin and semi-transparent. The musculature consists of slender, closely spaced transverse strands and fewer, more distinct, longitudinal bands. A tubular extension of the body wall

extends far down into the stalk. About 3 large endocarps are present on each side of the body.

Oral tentacles.

There is a circle of about 18 simple oral tentacles.

Dorsal tubercle.

Not seen.

Branchial sac.

The dorsal lamina is a plain membrane with a smooth margin. No folds on the walls of the branchial sac. Three (or possibly 4) tall narrow longitudinal bars on each side. Stigmata straight and narrow; about 3—5 per mesh, and probably more between the ventral longitudinal bar and the endostyle. Small papilla-like projections were seen on the longitudinal bars at their intersections with the transverse bars but they were indistinct and may have been artifacts due to the contraction of the branchial sac.

Gut.

This was very indistinctly seen. Oesophagus not seen. A wide rectangular sac lying vertically in the body, behind the branchial sac, apparently represented the stomach. Intestine narrow and passing on the left of the stomach and dorsally to the short rectum. Anus plain-edged.

Gonads.

One hermaphrodite gonad on each side of the body. Each gonad is almost spherical and of the polycarp type. The ovary is central with the few testis follicles lying on each side of it. Oviduct short. The 2 or 3 ducts leading from the testis follicles join to make one short sperm duct opening close to the oviduct.

Remarks.

The genus *Dicarpa* is placed in the family *Styelidae* because of its simple oral tentacles, polycarp-type gonads, straight stigmata, undivided dorsal lamina, and its endocarps. The form of the gonads suggests a close relationship with *Polycarpa*, from which it differs principally in lacking branchial folds. The absence of branchial folds is a character also found in some other styelid ascidians, although mainly in the compound forms of the family.

Cnemidocarpa platybranchia n.

Fig. 3.

M a t e r i a l : St. 371 (Haul No. 10), N W 63° 23′—N 24° 28′ W 63° 18′, Augu 1948; depth 5,850—5,860 m. 3 specir

Diagnosis.

Test with a thick coat of long h processes. Branchial sac without folds gonad on each side of the body.

External appearance.

The lengths of the three specimens a 0.6 and 0.6 cm. Body ovoid to de globular. Covered by a dense mass c hair-like test processes which are long the lateral parts of the body and short the dorsal and ventral surfaces. The ha arranged in bunches, with up to 12 o hairs arising from a common base; this a ment is most clearly seen on the ventral where the bunches are more widely than elsewhere. Foreign bodies are atta the hairs. The external siphons, whi spaced far apart on the dorsal side of the are smooth, conical or rounded projectio are free of hairs.

Test.

Not very thick but firm, and, where hairs, transparent.

Siphons.

Short. The arrangement of the lobes not be distinguished.

Body wall.

Thin, with muscles weakly developed or three large endocarps are present o side of the body.

Oral tentacles.

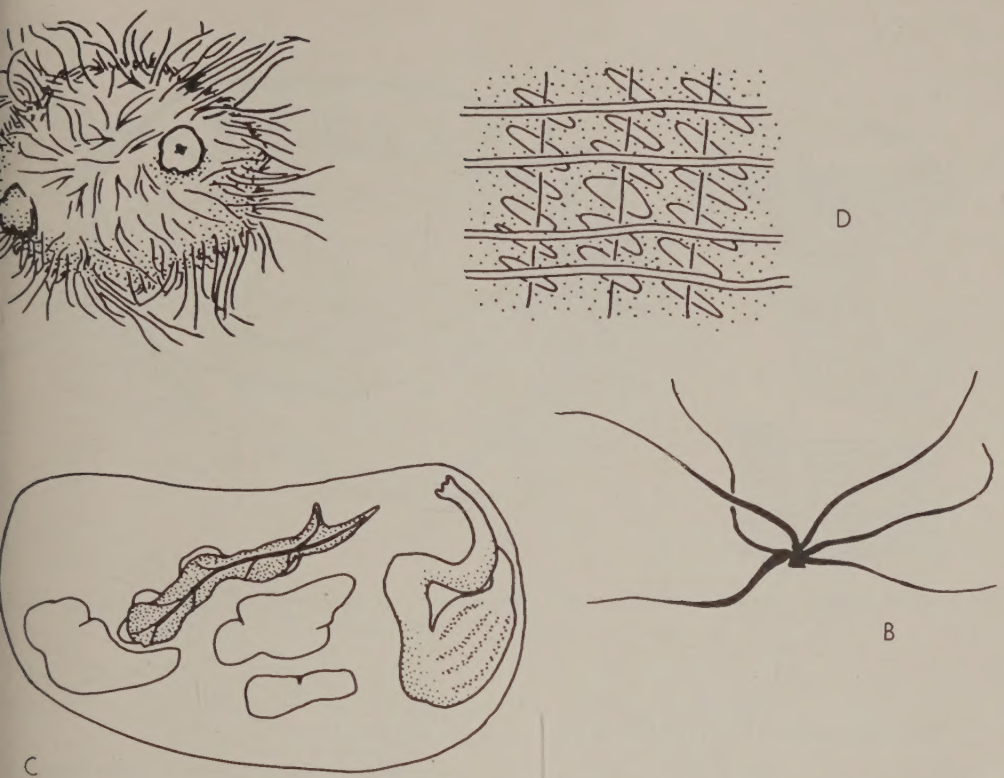
A circle of simple tentacles. The n could not be determined, but was pr between 16 and 24.

Dorsal tubercle.

Small, with a simple oblique slit.

Branchial sac.

Dorsal lamina a simple plain-edged brane. No folds on the branchial wall. T



Cnemidocarpa platybranchia n. sp. A, dorsal view of whole specimen; B, test-hair; C, specimen with left half removed, seen from the left, to show gut, endocarps, and gonad; D, part of branchial wall.

ty equally spaced longitudinal bars on
de. Interstigmatic and slender para-
ic transverse bars. Stigmata straight
al, longitudinal or lying obliquely at an
f about 40 degrees to the longitudinal
About two stigmata per mesh.

gut is confined to the posterior end of
ody. Oesophagus short and curved.
h ovoid to globular, with 8—10 complete
dinal folds on the walls. Intestine making
loop. Rectum ending in a lobed anus.

hermaphrodite gonad on each side of the
Long, slightly sinuous, and tapering to
rsal end. The ovary occupies most of
nad, and the testis follicles, which are
e applied to the sides of the ovary, from
they project. Oviduct and sperm duct
ogether and directed towards the atrial siphon. Gonads yellow-brown in alcohol-preserved material. The right gonad is sometimes divided near its dorsal end and each of the branches has an oviduct and sperm duct.

Remarks.

In the form of its gonads *C. platybranchia* is intermediate between *Styela* and *Cnemidocarpa*. The testis follicles, although closely applied to the ovary, project a little from its sides. The complete absence of folds on the branchial walls, however, clearly separates the new species from *Styela*. Within the genus *Cnemidocarpa* at least one species, *C. mortenseni* (Hartmeyer), has the brancial folds reduced to one on each side, and the present species may be regarded as carrying the process a stage further. For this reason the species is included in the genus *Cnemidocarpa*, although it might otherwise have been made the type of a new genus.

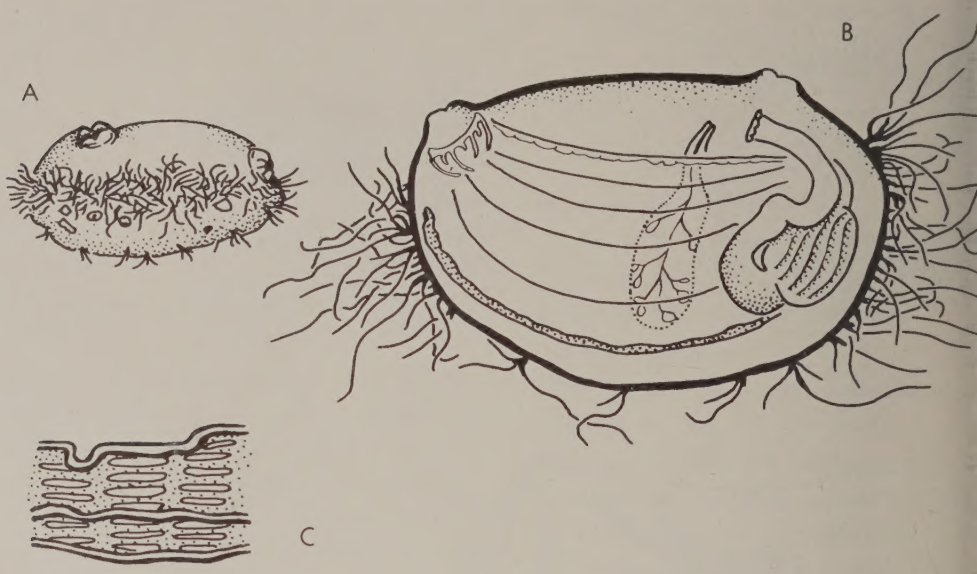


Fig. 4. *Cnemidocarpa bathyphila* n. sp. A, whole specimen; B, specimen with left half removed, seen fron
C, part of branchial wall.

Cnemidocarpa bathyphila n. sp.

Fig. 4.

Material: St. 342 (Haul No. 4), N 01° 03′ W 18° 40′—N 00° 58′ W 18° 37′, July 16th, 1948; depth 5,250—5,300 m. 5 specimens.

Diagnosis.

Test with long hair-like processes especially developed in an equatorial belt round the body. Branchial sac with 4 prominent folds on each side. Gut confined to the posterior part of the body. Stomach with 8—10 longitudinal folds. One gonad on each side of the body.

External appearance.

Body ovoid ranging from 0.8 cm. to 1.2 cm. in length. Equatorial belt of the body covered with a thick coat of long fine hairlike processes; dorsal surface almost free of hairs, and ventral surface with fewer hairs than the sides of the body. The hairs generally consist of 1 to 4 fine branches arising from a common point or short stem. Globigerina shells and debris adhere to the hairs. Body brown.

Test.

Rather thin but quite tough.

Siphons.

The siphons project a little from th surface of the body and are indistinctl

Body wall.

Thin, with a close irregular network muscle strands.

Oral tentacles.

About 16 slender, widely spaced tentacles situated on the edge of flange.

Dorsal tubercle.

Small, with a simple transverse oval

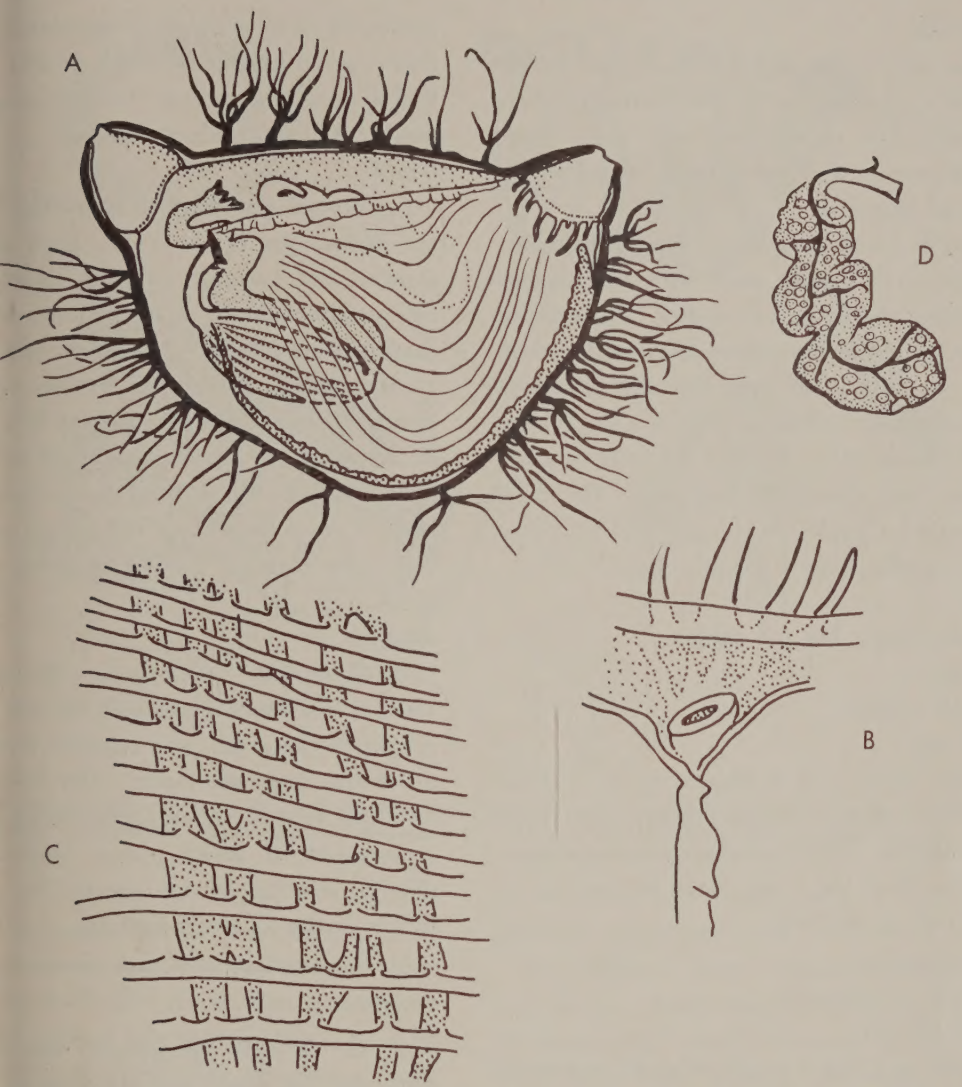
Branchial sac.

Dorsal lamina a smooth-edged me Four prominent folds on each side of t chial sac. In a large specimen the long bars were arranged as follows:

dorsal line 4(7)6(9)6(7)9(9)3 endos Three or four simple elongate stigmata p

Gut.

Confined to the posterior end of th Oesophagus curved and of moderate Stomach ovoid or barrel-shaped, wit complete longitudinal folds. Intestine wide tube lying close to the stom



Bathystyeloides atlantica n. sp. A, specimen with right half removed, seen from the right; B, dorsal tubercle; C, part of branchial wall; D, gonad.

; to the short rectum which has an plain-edged anus.

.

long sac-shaped, hermaphrodite gonad n side of the body. The gonads are almost l and lie just anterior to the gut. The ovary es most of the gonad and the testis follicles eral. The oviduct and sperm duct are d towards the base of the atrial siphon.

ks.

athyphila is distinguished from other species of the genus by the combination of the following characters: the hair-like processes of the test, the well-developed branchial folds, the possession of only one gonad on each side, and the position of the gut far back in the body.

Bathystyeloides atlantica n. sp.

Fig. 5.

Material: St. 342 (Haul No. 4), N 01° 03′ W 18° 40′—N 00° 58′ W 18° 37′, July 16th 1948; depth 5,250—5,300 m. One specimen.

Diagnosis.

Test with a coat of long branched or simple hair-like processes. Over 100 longitudinal bars on each side of the branchial sac. Testis follicles evenly distributed along the gonad.

External appearance.

Length 0.9 cm., depth 0.7 cm. Body rather triangular in lateral view, with the siphons occupying the upper two angles. The sides of the body, and to a less degree the dorsal surface, have a coating of long hair-like processes. Typically these processes arise as a single stem which divides into a number (up to 12 or more) of long fine thread-like branches. The hairs may also be single, or grouped in 2 or 3 processes arising from a common base.

Test.

Quite tough, but not thick.

Siphons.

With 4 lobes.

Body wall.

Quite thick, and having a dense irregular meshwork of fine muscle strands. The body wall is brown in the alcohol-preserved specimen. Two or three large endocarps are present on each side of the body.

Oral tentacles.

About 20; simple.

Dorsal tubercle.

Small, and with a simple obliquely transverse oval slit.

Branchial sac.

The dorsal lamina is a plain membrane. The body and branchial sac are contracted, and it is therefore difficult to decide whether the creases in the branchial walls are artifacts or true anatomical features, but it appears most probable that they are artifacts. Over 100 longitudinal bars are present on each side of the branchial sac. Neither transverse bars nor regular stigmata are present; instead there is a meshwork of irregular transverse stigmata, which, however, have normal ciliation.

Gut.

Oesophagus curved. Stomach ovoid and having 12 or 13 complete longitudinal f
short curved pyloric caecum is present
tine and rectum sinuous (because of
tion?). Anus with about 10 lobes.

Gonads.

One on each side, situated rather high
the dorsal edge of the body. Each g
elongate and twisting (owing to contra
and consists mainly of the ovary, wit
shaped testis follicles arranged along i
In the right gonad the sperm duct s
from the oviduct and is bent away fron
in the left gonad it accompanies the ov
open beside it. The oviduct is rather sh
is bent away from the atrial siphon,
curvature might be due to contractio
body.

Remarks.

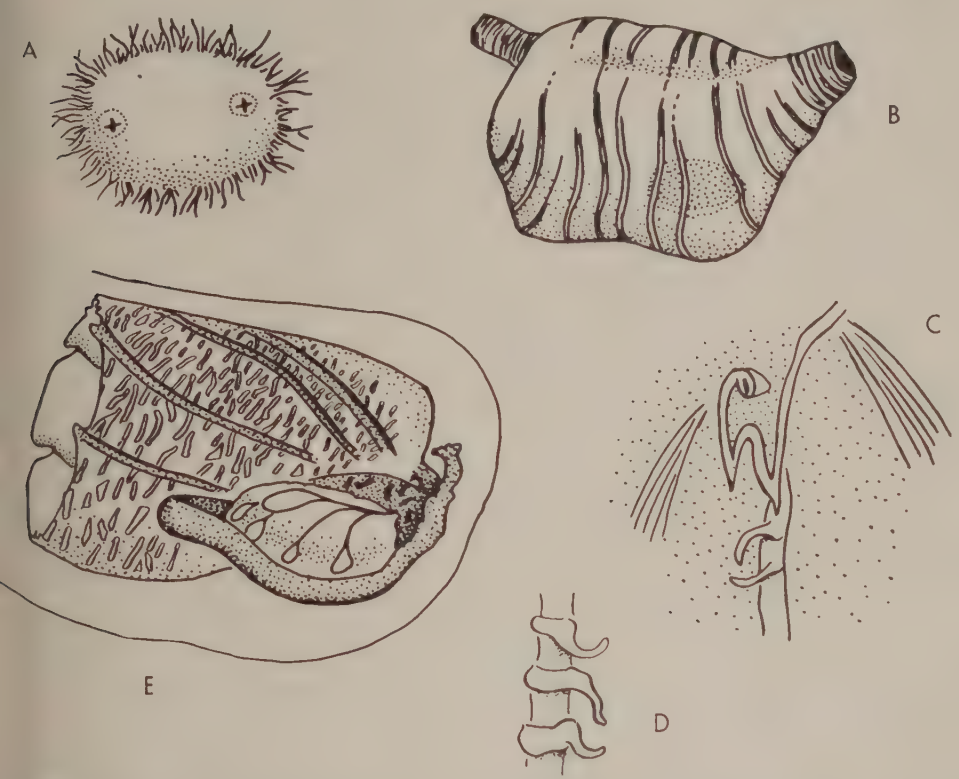
Bathystyeloides enderbyanus (MICH
1904), which has hitherto been the only
species in the genus, was collected fro
m. in the Antarctic Ocean. The new
from the Atlantic Ocean agrees closely
enderbyanus in many points, includ
detailed structure of the branchial sac.
differs in the following features:

(1) the possession of characteristic b
test hairs,

(2) the form of the gonads, especi
testis follicles which are not grouped
few large masses as they are in *B. ende*

(3) the greater number of longitudi
in the branchial sac, in specimens of sim

The first of these characters used in se
the two species deserves comment. In
ELSEN's original description of *B. ende*
the specimen is stated to be enveloped i
of filamentous Algae. It is hardly possi
filamentous Algae would be found
depths and this raises the question whe
enveloping filaments were in fact hair-
processes. If they were test process
only the second and third characters
to distinguish the species. As each of th



Hemistyela pilosa n. gen. n. sp. A, dorsal view of specimen; B, specimen with test removed, to show muscles; C, tubercle; D, languets;E, posterior part of body, seen from the left, to show gut, left gonad, and part of branchial sac.

d on a single specimen the range of varia- unknown, and it is possible that more ens would show intermediate conditions. our present information, however, it is s better to separate the Atlantic specimen ew species.

Hemistyela n. gen.

sis of the genus.

ons 4-lobed. Oral tentacles simple. line with languets. Branchial sac with s on each side. One polycarp type on each side of the body.

Iemistyela pilosa n. gen. n. sp.

Fig. 6.

rial: St. 342 (Haul No. 4), N 01° 03′ ° 40′—N 00° 58′ W 18° 37′, July 16th, depth 5,250—5,300 m. 2 specimens.

External appearance.

The lengths of the two specimens are 1.0 cm. and 0.8 cm. Body roughly ovoid. A slightly thickened ridge round the equator of the body bears many fine hair-like processes. Fewer hairs are present on the ventral surface, and very few or none, on the dorsal surface.

Test.

Pale buff in colour. The test on the dorsal surface of the body has many small rounded or rectangular scalelike plates, each minutely sculptured.

Body wall.

Thin, with stout bands of muscle passing round the body from the dorsal to the ventral side, and especially well developed on the dorsal and ventral areas. Endocarps were not found.

Siphons.

The siphons scarcely project above the surface of the body. Each is four-lobed.

Oral tentacles.

There are about 16 simple, quite long oral tentacles.

Dorsal tubercle.

Small, with a simple longitudinal narrow oval slit.

Branchial sac.

The dorsal lamina is represented by a row of at least 12 tapering hooked languets. There are 4 high folds on each side of the branchial sac; in the smaller of the two specimens the longitudinal bars were arranged as follows:

dorsal line 2(9) 3(12) 3(6) 4(7) 3 endostyle. The endostyle is large and conspicuous. There are no transverse bars and the branchial wall is divided into a meshwork of irregular transverse stigmata, as in *Bathystyeloides.*

Gut.

Oesophagus curved. Stomach large and ovoid or box-like; walls of stomach greenish and marked internally by irregular ridges which run partly transversely and partly longitudinally. The appearance of the stomach suggests a slight development of hepatic tubules. Intestinal loop curved to the left rather than ventrally. The rectum runs dorsally and ends about the level of the oesophagus, and to the left of it. Anus with about 8 shallow lobes.

Gonads.

One hermaphrodite gonad on each side, in the posterior part of the body and lying beside the stomach. The gonads are large, ovoid, and of the polycarp type. Each consists of a large mass of eggs, and a few pear-shaped testis follicles on each side. The common sperm duct runs along the dorsal side of the ovary and opens near the posterior end of the gonad. The oviduct was not clearly seen, but is probably short and lying beside the sperm duct.

Remarks.

This genus is difficult to place, having characters of both the families *Styelidae* and *Pyuridae.* The combination of the following features, however, indicates that it should be included in the *Styelidae;* simple oral tentacles, 4 branchial folds, and gonads of the polyc
The dorsal languets and the irregula
of the stomach wall (possibly form
mentary hepatic tubules) are charact
may point to some relationship
Pyuridae.

Family PYURIDAE

Culeolus suhmi Herdman

Fig. 7.

Culeolus perlatus Herdman, 1882, p
11, figs. 8, 9, pl. 13, figs. 1, 2; Michael
p. 183.

Culeolus suhmi Herdman, 1881, p.
Name, 1912, p. 540, figs. 27, 28, pl.
78—81, pl. 57, fig. 83; 1945, pp.
figs 246—250; Hartmeyer, 1912, pp.
Ärnbäck-Christie-Linde, 1928, p. 93.

Culeolus tanneri Verrill, 1885, p. 52
figs. 144, 145; 1885 a, p. 447.

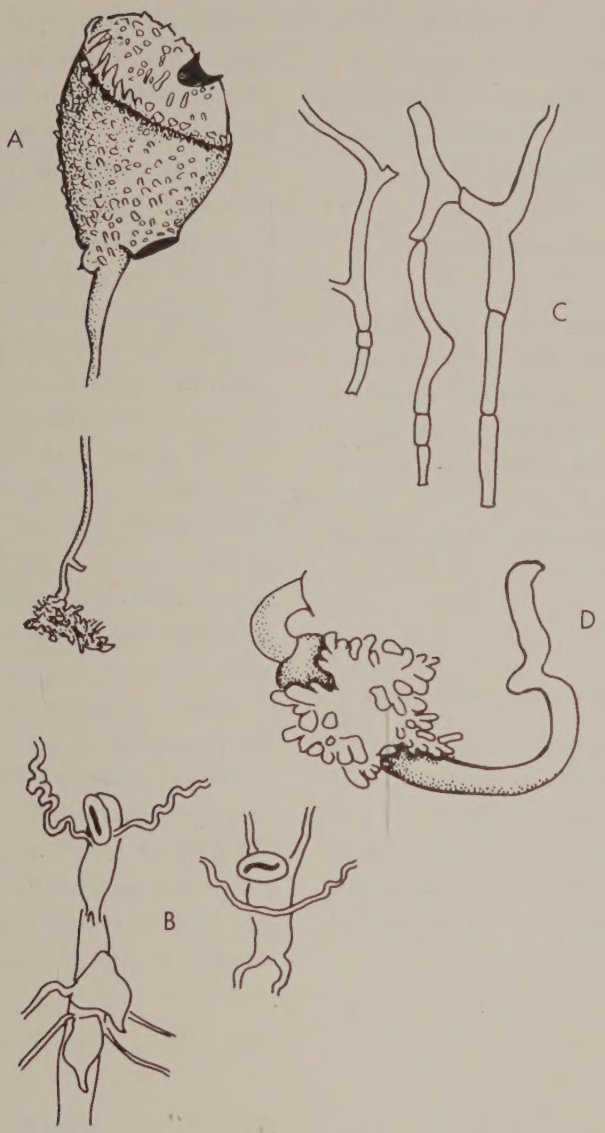
Material: St. 387 (Haul No. 13),
W 35° 24′—N 40° 34′ W 35° 52′, S
7th, 1948; depth 4,540—4,600 m. 6 s

External appearance.

In the largest specimen the body i
long and 1.5 cm. deep and the stal
cm long. In the smallest specimen th
0.7 cm. long and 0.6 cm. deep and
8.0 cm. long. In large specimens the
roughly triangular in outline, with a
ventral margin and obliquely truncate
margin. In small specimens the ventra
is straight but the dorsal and posterio
are arched so that the outline of the
dome shaped. Oral opening slightly p
and almost round. Atrial opening a wi
verse or triangular slit. Small round
gonal papillae cover the surface of t
they are specially developed as large f
scales forming a band which passes
round the body and encircles the atrial
Stalk slender.

Test.

Thin but firm.



Culeolus suhmi Herdman. A, specimen seen from the right; B, dorsal tubercle and ganglion of two specimens; C, spicules from branchial sac; D, gut.

vall.

n. Stout widely separated muscles pass the body in a dorsi-ventral direction.

us.

y the oral siphon projects above the sur- f the body as a short tube.

entacles.

mpound, flattened, and with rather few nes. The tentacles alternate in size, and largest specimen there were 19 tentacles.

Dorsal tubercle.

In one specimen examined the slit of the dorsal tubercle was narrow and obliquely longitudinal; in another specimen it was slightly S-shaped and transverse.

Branchial sac.

Dorsal lamina with a few large flat leaf-like languets; not more than 4 were counted in any specimen, but in most cases the branchial sac was damaged and the number of languets may

have been rather greater. The number of folds in the branchial wall could not be determined. Five —8 longitudinal bars on the folds and 1—3 bars between folds. Branched spicules present in the wall of the branchial sac.

Gut.

As described by VAN NAME (1945).

Gonads.

In some specimens there appeared to be only one gonad on each side, but in others there were two on each side. In one well-preserved specimen the left side had one gonad in the loop of the gut and the other gonad antero-dorsal to the gut, as in VAN NAME's (1945) description; on the right side the two gonads were close together.

General remarks on the collection

It is remarkable that such a small collection of ascidians should contain so large a number of new species. The high proportion of new genera and species collected by each major deep-sea expedition indicates that many still unknown ascidians may exist in the abyssal regions.

All the species in this collection sho other of two adaptations to life on the of a soft substratum. In two species (*suhmi* and *Dicarpa simplex*) the body i on a stalk which has, at its lower end of rooting processes serving to anchor th to the substratum. All of the remaining have the body covered with a coat fine test-hairs which, by forming a m support the body on the surface of clay. The exclusive presence of stalked at Station 387 (Haul No. 13), and covered species at the other two statio be correlated with differences in the n the sea floor. NYBELIN (1951) has stat of all the hauls made during the exp that at Station 387 was the richest in »perhaps owing to the fact, that the tr worked over a ridge on the bottom».

Material collected by previous exp has shown that a high proportion of th of abyssal ascidians are simple forms a proportion compound. The collection the Swedish Deep-Sea Expedition con compound ascidians, a result which the view that the simple forms are adapted to abyssal conditions.

LIST OF SPECIES OF ASCIDIANS RECORDED FROM DEPTHS OF MORE THAN 3,000 m.

	South Polar Sea	Atlantic Ocean	Indian Ocean	Pacific Ocean	Depth in M.
Family Molgulidae					
a bathybia (Hartmr.)	+	—	—	—	4,636
rilli (Van Name)	—	+	—	—	3,184
obylus indicus Oka	—	—	+	—	3,442
Family Pyuridae					
era splendens Mchlsn	+	—	—	—	350—4,636
lus antarcticus Herdm.	+	—	—	—	4,473
s moseleyi Herdm.	—	—	—	+	4,365
rrayi Herdm.	+	—	—	+	3,397—4,636
amidalis Ritter	—	—	—	+	4,010—4,066
mbens Herdm.	—	—	+	—	2,475—3,594
mi Herdm.	—	+	—	—	2,894—4,716
lemoesi Herdm.	—	—	—	+	4,140
ersus Oka	—	—	—	+	3,500
chuni Mchlsn.	—	+	—	—	4,990
rostigma singulare (Van Name)	—	+	—	—	5,005
Family Styelidae					
tyela pilosa n. gen. n. sp.	—	+	—	—	5,250—5,300
docarpa drygalskii (Hartmr.)	—	+	—	+	3,310
tybranchia n. sp.	—	+	—	—	5,850—5,860
hyphila n. sp.	—	+	—	—	5,250—5,300
bythia Herdm.	—	—	+	—	4,680
leri Ritter	—	—	—	+	4,010
illa Herdm.	—	—	—	+	3,090
cata Herdm.	—	—	+	—	3,510
amosa Herdm.	—	—	+	—	4,680
rpa albatrossi (Van Name)	—	+	—	—	2,556—3,659
a simplex n. gen. n. sp.	—	+	—	—	4,540—4,600
ncus discoideus Herdm.	—	—	—	+	4,140
dmani Mchlsn.	+	—	—	—	4,636
nutus Herdm.	—	—	—	+	5,625
tyeloides enderbyanus (Mchlsn.)	+	—	—	—	4,636
ntica n. sp.	—	+	—	—	5,250—5,300
Family Rhodosomatidae					
yosoma inaequale Redikorzev	—	—	—	+	985—3,638
scidia wyvillei Herdm.	—	—	+	—	4,680
scidia suhmi Herdm.	+	—	+	+	2,475—4,636
scidia michaelseni Ritter	—	—	—	+	3,927
Family Hypobythiidae					
ythius calycodes Moseley	—	—	—	+	5,220
Family Agnesiidae					
ia depressa n. sp.	—	+	—	—	5,850—5,860
Family Ascidiidae					
scidia vasculosa (Herdm.)	—	—	+	—	3,510
Family Octacnemidae					
emus herdmani Ritter	—	—	—	+	4,063—4,087

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